

# Self-Injurious Behavior in Adolescent Girls

## Association with Psychopathology and Neuropsychological Functions

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### Key Words

Self-injurious behavior, adolescents · Neuropsychology ·  
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### Abstract

**Background:** Self-injurious behavior (SIB) is increasingly popular in psychically ill adolescents, especially in girls with posttraumatic stress (PTSD) and personality disorders. Adolescents with SIB frequently exhibit neurofunctional and psychopathological deficits. We speculated that specific neuropsychological deficits and temperamental factors could predispose patients to SIB and prospectively explored adolescent psychiatric patients with and without SIB in order to find out differences in psychopathology, and neuropsychological or temperamental factors. **Sampling and Methods:** Ninety-nine psychically ill adolescent girls with SIB, aged 12–19 years and treated at our clinic, were prospectively recruited during a period of 5.5 years (1999–2005). The clinical (ICD-10) diagnoses were mainly substance abuse, eating disorders, depression, PTSD and personality disorders. The control group was also prospectively recruited during the same period and consisted of 77 girls with similar diagnoses and ages but no SIB. All patients were subjected to the same selection of clinical and neuropsychological tests, mainly self-rating questionnaires and tests evaluating executive functions. **Results:** Adolescent girls with psychiatric disease and SIB were more severely traumatized and de-

pressed. They reported severe emotional and behavioral problems and deficits of self-regulation. In addition, their parents more frequently had psychiatric problems. Temperament, intelligence, investigated executive functions and presence of dissociative symptoms were not different in patients with and without SIB. **Conclusions:** We could not verify our primary hypothesis that SIB is related to specific neuropsychological deficits or temperamental factors. SIB was associated with traumatic experience, depression, problems of self-regulation and parental psychiatric disease. The prevention of SIB should therefore focus on improving affect regulation, the management of emotional distress and problem-solving strategies.

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### Introduction

Self-injurious behavior (SIB), deliberate, repetitive self-harming actions like cutting, burning, poisoning, strangulating, etc., is a common problem especially in female adolescent psychiatric patients [1, 2]. Conceptualizations of SIB underline distinctions between self-injury, suicide, attempted suicide and parasuicidal actions along several dimensions including intent, mode of injury, mortality, chronicity and age at onset. Seven to fourteen percent of the adolescents admitted to harm themselves at any time in their life, and 20–45% of the older adoles-

cents report about ideas to commit suicide [3]. In a non-clinical sample, 4% of the military recruits admitted a history of deliberate self-harm (DSH) [4]. Parasuicidal actions and attempted suicide are frequently observed in adolescent patients with SIB [5], whereas completed suicide is a rare but possible complication in this age group [2, 6, 7]. Later in life, the risk of suicide after deliberate self-harm varies between 0.24 and 4.30% [3, 4].

Approximately 25,000 adolescents present every year at hospitals in the UK following nonfatal DSH. It is becoming apparent that the true numbers of DSH are much higher [3, 8]. A study of 8 states reported an annual rate of 259 emergency department evaluations for DSH per 100,000 population 15–19 years of age [9]. Among young people aged 7–24 years, the annual rate of emergency visits with DSH was 225 per 100,000. A mental disorder was diagnosed in 56%, including depressive disorders in 15% and substance use disorders in 7% of the visits. Approximately one half of the visits (56%) led to inpatient admission [10]. In Queensland, Australia, DSH within the previous 12 months was reported as frequently as 6.2% in school students, girls nearly 10 times more frequently than boys. The main methods used were cutting (59%) and overdosing (30%). Only 10% of them were treated in hospital [2].

There is no specific DSM-IV-TR diagnosis of SIB [11], but it may be classified among ‘impulse control disorder not otherwise specified’ (DSM-IV: 312.30, ICD-10: F 63.9) [12].

SIB often starts as an imitative behavior and is usually actualized by problems within the family or the peer group, disciplinary problems at school or work [13] and by crises of low self-esteem [14]. Originating impulsively and involving little or no premeditation [15], SIB serves as a fast-acting coping strategy for relieving tensions and for escaping from dissociative states. SIB may thus be considered as a maladaptive solution to overwhelming, intensely painful and negative emotions [16].

There is a close relationship between SIB and childhood trauma [6, 14, 17–19] and depression [20, 21]. Other related conditions are anxiety, oppositional defiant [22] and personality disorders, psychoses [23], as well as eating [24] and posttraumatic stress disorders (PTSD) [25]. Dissociative symptoms are strongly related to SIB [26]: patients with SIB, especially cutters [18], are more likely to dissociate compared to patients who do not injure themselves [17, 25].

There is a difference between overtly and covertly self-harming patients: overtly self-harming patients are characterized by an unstable self and impaired narcissistic self-regulation [27]. Patients with SIB, and especially

those with overt SIB, have a more profoundly disturbed narcissistic self-regulation than patients without self-destructive behavior.

Social and emotional self-regulation is represented in specific areas of the frontal cortex and the limbic system. The goals and the means to achieve them are represented in the prefrontal cortex. The left-sided prefrontal cortex regions are particularly involved in appetitive, approach-related, goals, whereas the right-sided prefrontal cortex regions are particularly important in maintaining goals that require behavioral inhibition and withdrawal, especially when strong alternative options are at hand. Other important structures involved in the regulation of affect and emotion are the anterior cingulate, hippocampus and amygdala [28]. Problems of behavior and emotion regulation and executive function (EF) deficits have been described in patients with PTSD and borderline personality disorder (BPD) [29], in children and adolescents with suicidal behavior [30], depressive and bipolar disorders [31], obsessive-compulsive disorder [32], Tourette syndrome [33], psychotic and psychopathologic disorders [34], conduct disorders [35], psychopathies [36], attention deficit hyperactivity disorder [37, 38], and disruptive, delinquent and aggressive behavior [39].

Temperamental factors have also been related to SIB. Temperament is neurochemically regulated by complex neural networks. Cloninger’s biosocial model [40, 41] includes 4 dimensions of temperament: novelty seeking, harm avoidance, reward dependence and persistence, and 3 dimensions of character: self-directedness, cooperativeness and self-transcendence. Barnow et al. [42], investigating adult BPD patients, found higher levels of novelty seeking especially in male, higher levels of harm avoidance in female patients and very low levels of self-directedness in patients of both sexes when compared to normal controls. The authors concluded that low levels of self-directedness are specific for BPD and that therapy of BPD should therefore take into account the high levels of comorbidity and suicidality in these patients.

To date it is not clear if SIB represents a ‘learned’, self-regulating behavior that helps patients with severe psychopathology to relieve severe inner tensions, feelings of guilt, dissociation, derealization and reproductions of former or continuing trauma. It is also not clear if SIB is influenced by protective factors or if there is a specific sociocultural or predisposing neurophysiologic background that relates to the onset of SIB.

Several studies have retrospectively examined comorbid neuropsychological dysfunctions in adult BPD patients [43]. BPD involves a specific neurocognitive pa-

thology that cannot only be explained by the presence of motivational or intrapsychic conflicts [44]. We are only aware of 1 report addressing the relationship between clinical symptoms in children with BPD and measures of frontal brain dysfunction [29]. There are no empirical studies exploring associations between SIB and neuropsychological and personality parameters in adolescent self-cutters. Based on previous studies in patients with BPD and our clinical experience that SIB patients often present with emotional and behavioral disturbances, low levels of self-control, impulsivity, a high rate of childhood adversities and impaired EF, we expected to find impaired neuropsychological functions in SIB patients. The purpose of the present study therefore was to prospectively explore if there are any sociocultural, personality or neuropsychological differences in adolescent psychiatric patients presenting with and without SIB.

## Patients and Methods

We prospectively investigated adolescent girls presenting with various severe psychiatric conditions and SIB at our in- and out-patient clinic between September 1999 and March 2005. These patients were compared to a group of our adolescent patients presenting within the same period with similar diagnoses and ages but no history of SIB. Inclusion criteria were severe psychiatric disease, willingness to participate in the extensive psychological testing and no previous or present psychotic, bipolar or severe neurological disorder. We included all available patients who fulfilled the inclusion criteria and who consented to participate in this prospective explorative study.

SIB was defined as any form of episodic or repetitive, direct or indirect impulsive SIB, including cutting, drug overdosing, scratching, hitting, burning, etc., regardless of whether the patients intended to kill themselves or not. The predominant form of SIB in our patients was intentional cutting. In addition, most patients also had experience with other forms of SIB, including suicidal attempts and parasuicidal behavior. Patients with only unintentional, assault-related injuries or injuries of undetermined intent were not included in our study.

The clinical (ICD-10) diagnoses were assessed by staff psychiatrists according to the Multi-axial Classification of Child and Adolescent Psychiatric Disorders [45].

All adolescents were assessed by highly trained research clinical psychologists. We documented sociodemographic data, age at onset of SIB and traumatic life events (defined by single or chronic sexual or/and physical abuse, parental loss or deprivation and emotional neglect). Parents or caretakers were questioned about the developmental history and a family history of psychiatric disorders.

All patients completed a number of standardized tests assessing:

- intelligence: Wechsler Intelligence Scale for Children-III (WISC-III), German version [46], or Wechsler Adult Intelligence Scale-Revised (WAIS-R), German version [47],

- concept formation and cognitive flexibility: Wisconsin Card Sorting Test (WCST) [48],
- interference: Stroop Color-Word Task, German version: Farbe-Wort-Interferenztest [49],
- mood: Beck Depression Inventory (BDI), German version [50],
- self-regulation: Narcissism Inventory (NI) [51],
- dissociative experience: Adolescent Dissociative Experiences Scale (A-DES), German version, Heidelberger Dissociation Inventory [52],
- personality: Junior Temperament and Character Inventory (JTIC), German version [53],
- aspects of temperament related to self-regulation: Early Adolescent Temperament Questionnaire-Revised (EATQ-R) [54], and
- behavioral problems and competencies Youth Self-Report (YSR), German adaptation [55].

All parents were asked to complete the Child Behavior Checklist (CBCL) [56] to rate the adolescents' individual behavioral adjustment.

We used the picture arrangement subtest of the WISC-III or WAIS-R as a measure of the EF, seriality.

### Statistical Analysis

The data were analyzed using SPSS 10.0 for Windows™. In addition to descriptive statistics, we analyzed group differences of sociodemographic, clinical and neuropsychological variables using *t* tests for independent samples,  $\chi^2$  analysis or Mann-Whitney *U* tests depending on the distribution of variables and scales. We used logistic multivariate regression analyses to find out associations of SIB and depression, trauma and various personality variables. All tests were applied 2-tailed with an  $\alpha$  level of 0.05.

## Results

We collected data of 99 patients with and 77 patients without SIB (control group). The mean age was 15.5 years (*SD* = 1.3; range = 12–18) in the SIB and 15.1 years (*SD* = 1.4; range = 12–19) in the control group. The mean age at onset of SIB was 13.9 years (*SD* = 1.8). All patients completed the psychological assessments. Two patients committed suicide during the study period, 1 of the SIB and 1 of the control group.

Comparing sociodemographic variables (table 1), there were no statistically significant differences between the 2 groups. Comparing diagnoses, the patients with SIB more often had diagnoses of BPD (F6) and PTSD (F4), i.e. significantly more traumatic experiences. They had fewer 'no psychiatric' and 'mental and behavioral disorders' (F5) diagnoses, and their parents had significantly more psychiatric diagnoses.

Comparing psychological assessments (tables 2 and 3), we found significant differences between the 2 groups in the CBCL variables 'thought problems' and 'delinquent

**Table 1.** Sociodemographic variables, diagnoses, and trauma experience

Variable	Patients with SIB	Patients without SIB	$\chi^2$	p	d.f.
Occupation father, classes			3.006	0.557, NS	4
0	8 (8.1)	7 (9.1)			
1	30 (30.3)	31 (40.3)			
2	45 (45.5)	28 (36.4)			
3	6 (6.1)	6 (7.8)			
4	10 (10.1)	5 (6.5)			
Occupation mother, classes			4.722	0.317, NS	4
0	1 (1.0)	1 (1.3)			
1	11 (11.1)	13 (16.9)			
2	46 (46.5)	38 (49.4)			
3	10 (10.1)	11 (14.3)			
4	31 (31.3)	14 (18.2)			
Parent psychopathology	45 (45.5)	23 (29.9)	4.437	0.035*	1
Setting			0.068	0.794, NS	1
Outpatient	65 (65.7)	52 (67.5)			
Inpatient	34 (34.3)	25 (32.5)			
Primary psychiatric diagnosis			39.113	0.000***	7
No psychiatric diagnosis	0 (0)	5 (6.5)			
F1	1 (1.1)	2 (2.6)			
F3	11 (11.1)	9 (11.7)			
F4	35 (35.4)	28 (36.4)			
F5	5 (5.1)	20 (26)			
F6	41 (41.4)	6 (7.8)			
F9	6 (6.1)	7 (9.1)			
Previous trauma experience	34 (34.3)	8 (10.4)	13.678	0.000***	1
Previous psychotherapy	43 (43.4)	29 (37.7)	0.597	0.44, NS	1
PTSD (F43.1)	22 (22.2)	4 (5.2)	9.974	0.002**	1
BPD (F60.31)	38 (38.4)	2 (2.6)	31.585	0.000***	1

Figures in parentheses are percentages. Significant results are italicized (\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p \leq 0.001$ ). Class 0: died or no contact, 1: academics, self-employed, 2: employees and public officials, 3: craftspeople, 4: housewives, retired and unemployed. Parent psychopathology: any psychiatric diagnosis of mother or father. No psychiatric diagnosis: these patients were severely disturbed on axis 5 (actual abnormal psychosocial conditions).

behavior'; YSR variables 'withdrawn', 'anxious/depressed', 'thought problems', 'internalizing score', 'delinquent behavior' and total problem score; depression score (BDI); NI variables 'helpless self', 'depersonalization/derealization', 'basal hope potential', 'insignificant self', 'negative body self', 'archaic withdrawal', 'greatness self', 'longing for an ideal self-object', 'autarky ideal' and 'value ideal'; JTCI for the factor 'cooperativeness'.

There were no significant differences between the 2 groups in the A-DES (Heidelberger Dissociation Inventory), in the A-DES-factor 'derealization/depersonalization' and in the factor levels of the EATQ-R.

Comparing the test results of traumatized and not traumatized girls within the SIB group, there were significant differences only in the NI variable 'asking for

praise and validation' and in the EATQ-R variable 'fear'. There were no significant differences between traumatized and not traumatized SIB patients in the CBCL, YSR, BDI, JTCI and A-DES.

The results of the neuropsychological analyses are summarized in tables 4 and 5. Analyses of the neuropsychological variables [levels of overall intelligence, picture arrangement subtest and all the assessed EF, i.e. the number of categories correctly scored in the WCST, the number of failures to maintain sets on the WCST and the 3 subtests of the Stroop (word reading, color naming and interference control)] showed no significant differences between the groups – neither between patients with or without SIB nor between traumatized and not traumatized SIB patients.



**Table 2.** Results of CBCL and YSR of patients with and without SIB

	Patients with SIB	Patients without SIB	t or Mann-Whitney U test	
			t or z	p
CBCL				
Withdrawn	7.07 ± 3.76	5.93 ± 3.42	1.67	0.10, NS
Somatic complaints	53.52	46.26	-1.27	0.21, NS
Anxious/depressed	11.2 ± 6.09	9.65 ± 5.53	1.36	0.18, NS
Social problems	56.64	56.35	-0.05	0.96, NS
Thought problems	52.47	41.27	-2.04	0.04*
Attention problems	6.33 ± 3.68	5.49 ± 4.15	1.09	0.277, NS
Delinquent behavior	58.25	46.10	-2.084	0.04*
Aggressive behavior	9.81 ± 5.04	9.65 ± 7.77	0.12	0.91, NS
Internalizing score	20.44 ± 9.87	17.04 ± 8.06	1.75	0.08, NS
Externalizing score	49.16	39.63	-1.75	0.08, NS
Total problem CBCL score	50.68 ± 17.97	43.86 ± 26.69	1.08	0.29, NS
YSR				
Withdrawn	89.23	69.83	-2.65	0.008**
Somatic complaints	76.33	66.10	-1.49	0.14, NS
Anxious/depressed	15.76 ± 5.68	11.46 ± 6.21	4.57	0.000***
Social problems	81.84	75.65	-0.86	0.39, NS
Thought problems	83.92	68.26	-2.22	0.03*
Attention problems	8.01 ± 3.18	7.19 ± 3.31	1.59	0.12, NS
Delinquent behavior	87.51	66.39	-2.95	0.003**
Aggressive behavior	9.92 ± 4.9	10.29 ± 5.74	-0.43	0.67, NS
Internalizing score	25.96 ± 8.93	20.29 ± 10.16	3.45	0.001**
Externalizing score	16.11 ± 7.61	15.04 ± 8.38	0.81	0.42, NS
Total problem YSR score	87.84 ± 23.46	77.07 ± 21.75	2.54	0.01*

Figures are means ± SD or mean ranks. Statistically significant results are italicized (\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ ).

Logistic linear regression analysis for finding predictors of SIB showed significant effects for depression, YSR factors 'delinquent behavior', 'trauma' and narcissistic factor 'longing for an ideal self-object'. Only 'delinquent behavior' (20% risk increase) and 'trauma' (5-fold risk increase) emerged as strong predictors (table 6).

## Discussion

Our data do not support our primary hypothesis that SIB is associated with sociocultural, personality or neuropsychological problems. Our patients with SIB felt more depressive and more frequently had personality disorders. They were more often traumatized, had a lower self-esteem and self-efficacy, and more frequently devaluated themselves. Both groups of patients, those with

and without SIB, had a similar temperament and character. Both groups of patients had similarly disturbed EF, i.e. difficulties in finding and keeping strategies, flexibility problems and problems in selecting relevant from irrelevant information.

Our data seem to support theories that explain SIB as a 'learned' behavior [16] independent of underlying neuropsychological problems. According to this model, traumatic experiences and parental pathology predispose to SIB and depression. SIB helps to cope with the psychic consequences of trauma, depression and related unpleasant feelings. SIB, initially discovered as a means to reduce tension, later becomes a learned behavior. In our patients, trauma and depression were most predictive of SIB. This is consistent with previous findings about the pathogenic role of trauma [6, 17–19] and depression [20, 21, 57] for developing SIB. In some patients, narcissistic 'asking for praise and validation' or sympathy may be a motive for

**Table 3.** Results of BDI, A-DES, EATQ, and JTICI of patients with and without SIB

	Patients with SIB	Patients without SIB	t or Mann-Whitney U test	
			t or z	p
BDI	<i>24.9 ± 11.44</i>	<i>16.88 ± 9.3</i>	<i>4.39</i>	<i>0.000***</i>
A-DES				
Derealization/depersonalization score	23.9 ± 18.5	17.2 ± 17.5	0.052	NS
Total score	91.47 ± 51.56	78.32 ± 62.21	0.84	0.41, NS
NI				
Helpless self	<i>47.77 ± 15.94</i>	<i>37.74 ± 14.23</i>	<i>3.99</i>	<i>0.000***</i>
Loss of control over affect/impulse	16.66 ± 5.17	15.24 ± 4.36	1.78	0.08, NS
Depersonalization/derealization	<i>16.49 ± 7.00</i>	<i>14.14 ± 6.15</i>	<i>2.15</i>	<i>0.03*</i>
Basal hope potential	<i>23.72 ± 9.46</i>	<i>31.06 ± 9.96</i>	<i>-4.59</i>	<i>0.000***</i>
Insignificant self	<i>31.13 ± 9.9</i>	<i>226.8 ± 8.78</i>	<i>2.71</i>	<i>0.007**</i>
Negative body self	85.76	63.43	-3.12	<i>0.002**</i>
Social isolation	27.05 ± 9.76	24.71 ± 8.26	1.56	0.12, NS
Archaic withdrawal	<i>34.63 ± 9.3</i>	<i>31.56 ± 9.16</i>	<i>2.03</i>	<i>0.044*</i>
Greatness self	<i>24.45 ± 7.65</i>	<i>27.97 ± 7.81</i>	<i>-2.77</i>	<i>0.006**</i>
Longing for an ideal self-object	<i>27.56 ± 8.05</i>	<i>30.52 ± 6.44</i>	<i>-2.44</i>	<i>0.016*</i>
Asking for praise and validation	26.73 ± 9.58	28.32 ± 8.85	-1.04	0.30, NS
Narcissistic rage	28.8 ± 9.16	28.44 ± 8.71	0.25	0.81, NS
Autarky ideal	<i>27.45 ± 7.13</i>	<i>30.17 ± 7.81</i>	<i>-2.23</i>	<i>0.027*</i>
Object depreciation	29.99 ± 8.15	28.3 ± 7.25	1.32	0.19, NS
Value ideal	<i>19.49 ± 5.04</i>	<i>21.68 ± 5.53</i>	<i>-2.55</i>	<i>0.012*</i>
Symbiotic self-protection	38.88 ± 6.82	38.88 ± 5.82	0.003	0.997, NS
Hypochondriac anxiety bonding	10.07 ± 3.85	11.31 ± 4.07	-1.91	0.06, NS
Narcissistic gains from illness	69.77	82.99	-1.86	0.06, NS
EATQ				
Activation control	23.08 ± 6.08	24.61 ± 5.17	-1.25	0.21, NS
Affiliation	30.85 ± 5.46	29.66 ± 5.35	1.04	0.30, NS
Aggression	27.91 ± 6.62	27.97 ± 6.3	-0.04	0.97, NS
Activity level	17.43 ± 4.66	18.57 ± 4.22	-1.18	0.24, NS
Attention	21.22 ± 3.73	21.54 ± 3.7	-0.4	0.69, NS
Depressive mood	21.02 ± 4.74	19.43 ± 4.33	1.63	0.11, NS
Fear	14.95 ± 4.86	15.34 ± 4.91	-0.38	0.71, NS
Inhibitory control	33.36 ± 5.8	35.37 ± 5.11	-1.70	0.09, NS
Frustration	29.37 ± 6.65	29.00 ± 4.81	0.314	0.75, NS
Pleasure sensitivity	23.97 ± 6.23	23.17 ± 6.11	0.62	0.54, NS
High intensity pleasure/surgency	49.39	44.31	-0.87	0.38, NS
Perceptual sensitivity	16.95 ± 5.18	17.33 ± 4.06	-0.38	0.71, NS
Shyness	20.1 ± 5.3	22.17 ± 5.67	-1.78	0.08, NS
JTICI				
Novelty seeking	23.89 ± 7.07	22.44 ± 6.44	1.07	0.29, NS
Harm avoidance	22.97 ± 5.96	21.74 ± 7.63	0.92	0.36, NS
Reward dependence	18.56 ± 4.18	17.21 ± 4.28	1.61	0.11, NS
Persistence	14.72 ± 3.45	14.82 ± 3.79	-0.14	0.89, NS
Self-directedness	22.60 ± 5.39	24.68 ± 5.8	-1.81	0.07, NS
Cooperativeness	27.78 ± 4.99	25.36 ± 5.32	2.35	<i>0.021*</i>
Self-transcendence	18.8 ± 5.39	18.44 ± 6.18	0.32	0.75, NS

Figures are means ± SD or mean ranks. Statistically significant results are italicized (\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ ).

**Table 4.** Intellectual functions and neuropsychological variables in patients with and without SIB

	Patients with SIB	Patients without SIB	$\chi^2$	p
Intelligence (axis 3)			3.965	NS
Above average	13 (14.8)	5 (7.1)		
Average	61 (69.3)	58 (82.9)		
Below average	14 (15.9)	7 (10)		
Picture arrangement (WISC-III)			0.478	NS
Not impaired	65 (75.6)	49 (74.2)		
Mildly impaired	14 (16.3)	13 (19.7)		
Severely impaired	7 (8.1)	4 (6.1)		
Categories completed (WCST)			1.221	NS
Not impaired	52 (59.1)	48 (67.6)		
Mildly impaired	14 (15.9)	9 (12.7)		
Severely impaired	22 (25)	14 (19.7)		
Failure to maintain set (WCST)			1.602	NS
Not impaired	46 (52.3)	36 (50.7)		
Mildly impaired	18 (20.5)	20 (28.2)		
Severely impaired	24 (27.3)	15 (21.1)		
Word reading			3.04	NS
Not impaired	41 (65.1)	43 (79.6)		
Impaired	22 (34.9)	11 (20.4)		
Color naming			1.31	NS
Not impaired	26 (41.3)	28 (51.9)		
Impaired	37 (58.7)	26 (48.1)		
Interference control			0.139	NS
Not impaired	27 (42.9)	25 (46.3)		
Impaired	36 (57.1)	29 (53.7)		

Figures in parentheses are percentages.

SIB. In our patients such narcissistic traits did not prove significant.

Our results do not confirm previous interpretations that neuropsychological problems predispose patients to SIB [29, 30] but support observations that EF are unspecifically disturbed in a variety of psychiatric conditions [31, 33–39]. In our sample, absence of trauma and psychically healthy parents seemed to protect against SIB [58].

Our adolescent SIB patients – similar to adults [27] – had an unstable self and low self-esteem and confidence. They had a distorted body image and expected relief from actual conflicts and associated feelings of help- and hopelessness. Van Heeringen et al. [59] described strong feelings of hopelessness in adult patients with attempted suicide, and Ystgaard et al. [14] reported feelings of low self-esteem in adolescents with deliberate SIB. Our patients with SIB had inadequate coping strategies against bad feelings and used SIB as a means of self-regulation.

**Table 5.** Intellectual functions and neuropsychological variables in SIB patients with and without trauma

	SIB patients with trauma	SIB patients without trauma	$\chi^2$	p
Intelligence (axis 3)			0.21	NS
Above average	4 (13.8)	9 (15.3)		
Average	21 (72.4)	40 (67.8)		
Below average	4 (13.8)	10 (16.9)		
Picture arrangement (WISC-III)			0.20	NS
Not impaired	22 (78.6)	43 (74.2)		
Mildly impaired	4 (14.3)	10 (17.2)		
Severely impaired	2 (7.1)	5 (8.6)		
Categories completed (WCST)			1.29	NS
Not impaired	16 (57.2)	36 (59)		
Mildly impaired	3 (10.7)	11 (18)		
Severely impaired	9 (32.1)	14 (23)		
Failure to maintain set (WCST)			0.66	NS
Not impaired	14 (50)	32 (52.4)		
Mildly impaired	5 (17.9)	14 (23)		
Severely impaired	9 (32.1)	15 (24.6)		
Word reading			2.25	NS
Not impaired	20 (77)	23 (59)		
Impaired	6 (23)	16 (41)		
Color naming			0.1	NS
Not impaired	11 (42.3)	15 (38.5)		
Impaired	15 (57.7)	24 (61.5)		
Interference control			2.05	NS
Not impaired	14 (53.8)	14 (35.9)		
Impaired	12 (46.2)	25 (64.1)		

Figures in parentheses are percentages.

**Table 6.** Logistic linear regression analysis: depression, delinquent behavior, trauma and longing for an ideal self-object

	Regression coefficient ( $\beta$ )	OR	p
Depression (BDI)	0.08	1.083	0.000***
Delinquent behavior (YSR)	0.252	1.287	0.000***
Trauma	1.627	5.091	0.005**
Longing for ideal SO (NI)	–0.1	0.905	0.003**
Constant	–0.707	0.750	NS

SO = Self-object. \*\* p < 0.01, \*\*\* p < 0.001.

The mean age at onset of SIB was 13.85 years, no patient was less than 12 years old. This confirms observations that SIB is only rarely observed before the onset of puberty [60].

The predominant clinical diagnoses in our SIB patients were affective (ICD-10 F3: 11.9%), neurotic, stress-related and somatoform (ICD-10 F4: 35.8%), mental and behavioral disorders (ICD-10 F5: 14.2%), and personality disorders (ICD-10 F6: 26.7%). This is consistent with other reports about SIB being associated with depressive, anxiety and behavioral disorders [22], PTSD [25], as well as eating [24] and personality disorders [23].

Our data do not support earlier findings that patients with SIB, and especially cutters, more often present with dissociative symptoms compared to noninjurors [17, 18, 25, 26]. This may be explained by the observation that adolescents, independently of their psychiatric disorder, escape more often and more easily into dissociative states when compared to adults. Although a large proportion of our patients with SIB were diagnosed as having BPD or PTSD, we found no strong association between the incidence of severe dissociative symptoms and BPD [61], suicidal behavior [62] or PTSD [63].

Temperament and character in our patients were only weakly associated with SIB. We found better cooperativeness in SIB patients, which was possibly related to pronounced helplessness. This has not been reported previously. Adult patients with attempted suicide scored higher in the temperamental dimension 'harm avoidance' and lower in the character dimensions 'self-directedness' and 'cooperativeness' [59] when compared to normal controls. Studies in adult patients with depression [64, 65], previous suicide attempts [66] and BPD [42] found associations between SIB and 'harm avoidance' or 'novelty seeking'. This was not confirmed in our patients. Such discrepancies may, however, be explained by differences in the study populations (e.g. adolescents vs. adults, female vs. male patients) or by differences in maturity, flexibility, motivation and in the patient-therapist relationship.

Self-consciousness and self-awareness were low in our SIB patients. They also had severe difficulties in identifying and handling external and internal problems. Improving problem-solving strategies and mental health awareness could help SIB patients in changing their behavior. To date it is not clear if EF training could help in reducing psychopathology or SIB.

Our study, although very elaborate and conducted in a large sample of patients, bears various limitations. First, our sample is highly selected and comprises SIB patients referred to our psychiatric clinic. Our findings cannot therefore simply be extended to self-harming activities in unselected populations. Second, our sample consisted only of adolescent girls, our results and interpretations

are therefore limited to female adolescents. Third, the only criterion that differentiated between the 2 groups was the presence of SIB. Therefore both groups of patients had heterogeneous clinical diagnoses, and we did not control for disease severity. The number of patients with personality disorders was significantly different in the SIB and the control groups. The number of mandatory hospital admissions was, however, equal in both groups. Due to the different diagnostic spectrum in the SIB and non-SIB patients, our results must be interpreted with caution. Fourth, we did not perform subgroup analyses, e.g. for arm versus wrist cutters, suicidal versus nonsuicidal patients, comorbidities, etc., because of the relatively small number of patients in such subgroups. Fifth, we mainly used self-report questionnaires, the validity of our results therefore depends on the cooperation and forthrightness of our study participants, who nevertheless were highly motivated. In addition, we defined psychopathology only by clinical diagnoses. Sixth, we only investigated a few aspects of EF and compared the results to the diagnosed control group and adolescent standards but not to a specific control group. On the other hand, various parameters cannot be assessed by external or not cooperation-dependent methods, and the use of an extensive standardized test battery that included neuropsychological and psychosocial measures of various sources (self, external and parental rating) may be considered as an accessible optimum. Future research, hopefully stimulated by our results, should therefore focus on aspects like larger subgroups (possibly only feasible with a multicenter approach), healthy nonclinical controls and additional neurophysiologic tests.

In summary, we found impairments of self-related awareness and conscience and disturbed EF in adolescent girls with severe psychiatric diagnoses and with or without SIB. Our primary hypothesis that temperamental or character changes are relevant to SIB must therefore be rejected. Further studies especially focusing on subgroups of patients with SIB, e.g. traumatized versus not traumatized, and the therapeutic relevance of our data are needed.

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